

SECTION 15945

VARIABLE FREQUENCY DRIVE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections apply to work of this Section.

1.2 SUMMARY

- A. Provide variable frequency drives as indicated other mechanical specification sections. .
- B. All variable frequency drives shall be from the manufacturer listed, and shall be mounted as described in other mechanical specification sections.

1.3 QUALITY ASSURANCE

- A. Underwriters Laboratories, Inc.: Units shall be UL Listed.
- B. IEEE Standard 519-1981: Unit line noise shall conform to IEEE Standard for special applications.
- C. FCC Rules and Regulations, Part 15, Subpart J: Unit shall conform to FCC requirements for radio frequency interference.
- D. Service Conditions: Unit shall be constructed to operate at 3,000 feet elevation without deaerating, - 10° C to 50°C ambient temperature range and 95% non-condensing humidity.
- E. Warranties
 - 1. All units shall be warranted for a period of 12 months from date of shipment. Any warranty expense during that time shall be born entirely by the manufacturer, including any travel costs or living expenses necessary to repair in warranty equipment.
 - 2. Provide extended warranties.
- F. Start-up Service: The manufacturer shall provide start-up assistance in the form of a factory-trained service technician.
- G. Factory Tests: Drive unit shall be pre-tested and cycled with a motor load at elevated temperature at the factory prior to shipment.
- I. Acceptable Drive Manufacturers:
 - 1. ABB
- J. Acceptable Reactor Manufacturers:
 - 1. MTE Corporation

1.4 SUBMITTALS

- A. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

- B. Product Data: Submit catalog sheets showing voltage, controller size, ratings and size of switching and over-current protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Test Reports: Indicate field test and inspection procedures and test results.
- D. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

PART 2 PRODUCTS

2.1 GENERAL

- A. Variable torque AC drive shall consist of adjustable frequency controller capable of driving standard AC induction motor.
- B. Product Description: NEMA ICS 7, enclosed variable frequency controller suitable for operating indicated loads. Select unspecified features and options in accordance with NEMA ICS 7.1.

2.2 BASIC DESIGN

- A. Adjustable frequency drive shall produce adjustable frequency and voltage output. To eliminate need for isolation transformers and/or line suppression equipment, input line filters shall be integral part of input section of drive.
- B. Drives shall employ pulse width modulation output wave form. Step-type controllers will not be acceptable.
- C. Adjustable frequency drive shall comply with FCC rules and regulations part 15 subpart J regarding radio frequency interference.
- D. Line noise shall be no greater than 3% harmonic distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE standard 519-1981 for special applications.
- E. Drives applications for motor 20 horsepower and larger shall be provided with line reactors, sized as appropriate based on motor nameplate rating. Reactors shall be located in the bypass/isolation enclosure, or shall be provided with their own enclosure for floor or wall mounting.
- E. Bypass: The VFD supplier shall supply an integral bypass enclosure with the following options.
 - 1. Input disconnect and appropriate fusing.
 - 2. Contactor bypass using electromechanical contactors.
 - 3. Isolation disconnect for manual isolation of VFD.
 - 4. Thermal over-load relay.
 - 5. Control transformer, fused.
 - 6. Manual or auto bypass selection.
- F. Drives shall be variable torque type suitable for fan and pumps applications.

2.3 CONTROL PANEL

- A. Operator's control panel shall include the following:
 - 1. Hand/Off/Auto Switch
 - 2. Local/Remote Switch
 - 3. Manual Speed Control
 - 4. Integral disconnect switch.
 - 5. Dry contacts for interlock with DDC Control System
- B. The following drive status indicator lights shall be included on control panel.
 - 1. Frequency
 - 2. Mode
 - 3. Over current
 - 4. Over voltage
 - 5. Over temperature
 - 6. External interlock
 - 7. Overload
 - 8. Operating error
- C. Control logic for the drive shall contain the following customer adjustment:
 - 1. Minimum Speed Adjustment
 - 2. Maximum Speed Adjustment
 - 3. Gain and Offset Adjustments for signal follower
 - 4. Overload
 - 5. Current Limit
- D. In addition, drive shall contain a soft key type control panel for adjustment of the following functions:
 - 1. Acceleration Time -- Adjustable from approximately 0.1 to 160 seconds
 - 2. Deceleration Time -- Separately adjustable from approximately 0.1 to 1600 seconds
 - 3. Variable Overload -- To protect motor from excess current at low speeds 150% for 1 minute
 - 4. High Starting Torque -- 150% current for 1 minute shall be selected for starting
 - 5. Follower Selection
 - 6. Deceleration Control or Coast to Rest
 - 7. Reverse Rotation
 - 8. Output Frequency -- 50 or 60 Hz
 - 9. Output Voltages -- 0 to nominal
 - 10. Adjustable Carrier Frequency of 4-16 KHZ in 2Khz increments.
- E. The following troubleshooting lights shall be supplied: Fault Codes
- F. In addition to start/stop and variable speed features in the drive, the following features shall be supplied as standard:
 - 1. 4-20mA or 0-10VDC follower capability
 - 2. Current limit protection
 - 3. Independently adjustable acceleration and deceleration
 - 4. Automatic restart
 - 5. Over-voltage protection
 - 6. Under-voltage protection
 - 7. Over-temperature protection
 - 8. Ground fault protection
 - 9. 98% efficiency
 - 10. All-steel enclosure, NEMA 1 enclosure with Integral disconnects switch.

PART 3 EXECUTION

3.1 GENERAL

- A. Install variable frequency drives in accordance with manufacturer's installation instructions.

End of Section